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12-1-1951

# Marketing Lambs - Comparison of Liveweight Method and Carcass Weight and Grade Method

O. Nervik

D. G. Paterson

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### Recommended Citation

Nervik, O. and Paterson, D. G., "Marketing Lambs - Comparison of Liveweight Method and Carcass Weight and Grade Method" (1951). *Bulletins*. Paper 416.

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LETIN 416 • DECEMBER 1951

# MARKETING LAMBS

*Comparison of*

LIVEWEIGHT  
METHOD AND  
CARCASS  
WEIGHT  
AND  
GRADE  
METHOD

AGRICULTURAL ECONOMICS DEPARTMENT  
AGRICULTURAL EXPERIMENT STATION  
SOUTH DAKOTA STATE COLLEGE BROOKINGS

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## Acknowledgment

This publication on marketing lambs by carcass weight and grade summarizes part of a study conducted by the North Central Livestock Marketing Research Committee in cooperation with the Bureau of Agricultural Economics and the Bureau of Animal Industry, U. S. Department of Agriculture. The South Dakota project was conducted by the Department of Agricultural Economics and the Department of Animal Husbandry. J. W. Cole, formerly of the Department of Animal Husbandry, did all the grading for the Experiment Station. Ellis A. Pierce of the Animal Husbandry Department also assisted in the study. The authors also would like to express their appreciation to John Morrell & Co. for their cooperation.

# MARKETING LAMBS — *Comparison of* LIVEWEIGHT METHOD AND CARCASS WEIGHT AND GRADE METHOD

OTTAR NERVIK and DAVID G. PATERSON<sup>1</sup>

Methods of selling livestock have changed considerably as our economy has become more industrialized. In early colonial days farmers could sell their livestock directly to consumers or to local butcher shops. Since adequate weighing facilities were not available, sale was usually by head. Each of the parties made his own estimates of the amount and quality of meat he could get from the carcass. As cities became larger it proved more difficult for farmers to sell directly to local consumers or merchants. More and more animals were sold through public markets for processing in meat packing plants.

In today's public markets, farmers are dealing with salesmen and buyers who specialize in livestock trade, and who are familiar with wholesale and retail quotations on meat products which finally decide the value of live animals. Sale is usually made on the basis of live weight, with buyer and seller both making independent estimates of the dressing percentage (yield) and grade of carcass. In making such estimates the buyer, especially the packer buyer, has an advantage because he can check his estimate with slaughter records from the plant.

Still another method of selling livestock is used in some foreign countries and in a few packing plants in the United States. Under this system

farmers are paid according to the weight and grade of the carcass itself.

The first method, sale by head, is no longer in common use for slaughter livestock. This method of sale seems to be very simple but is really the most difficult method for both seller and buyer. It makes it necessary to estimate both the live weight and dressing percentage of the animal. In addition, an estimate has to be made of the grade of the carcass.

The second and most widely used method of selling, by live weight, removes part of the guess work because the live weights are determined by scales. Buyers and sellers still have to estimate the dressing percentage and grade of the carcass.

In the third method, prices are based on the weight and grade of the carcass. Since the value of the animal is determined by the pounds of meat and by-product it produces, this system will be more similar to methods used in determining wholesale prices. In this method the carcasses are weighed and graded, and prices are based on these factors. Thus this system removes still more of the guess work in selling. To put it into general use, no changes would be required in procedures and pricing methods for lamb carcasses in wholesale markets.

<sup>1</sup>Assistant Agricultural Economist and former Assistant Agricultural Economist, South Dakota Agricultural Experiment Station.

Since sales by carcass weight and grade remove more of the guess work than the present system, it is only natural to ask: Why is livestock not sold on this basis? A new method of marketing may require considerable change in packing house procedure. Changes also may have to be made in the established methods of selling and buying in livestock markets. Commission men and all other kind of sellers, as well as buyers, will have to be trained in methods used in this system.

### Purpose and Method

The purpose of this study is to investigate whether the marketing methods for lambs can be improved by selling them on the basis of carcass weights and grades instead of by live weight. The approach taken is to examine whether the present system does an adequate job in reflecting to sellers the actual wholesale values of the carcasses. However, before any recommendation can be made, it will also be necessary to examine whether the carcass weight and grade method is practical. If the cost of the latter method is found to be too high, the benefits from the added accuracy may be more than offset. In this preliminary study the emphasis is placed on the problem of how accurately the system reflects carcass values.

When lambs are purchased the buyer makes an estimate of their actual carcass values by estimating their dressing percentages (yield) and carcass grades. The producer is paid according to these estimates. If the buyer's estimate is too high the producer is overpaid, if too low he is underpaid.

An appraisal of the present method must be based on an examination of the accuracy of the buyer's estimates of yield and grade. The procedure in this study was to have a buyer at a local packing plant make estimates of yield and grade on 32 lots, comprising 487 lambs, most of which were selected from direct shipment.<sup>2</sup> These estimates were then compared with actual yields and with a Federal grader's carcass grades.<sup>3</sup> Each lamb was graded individually, each full grade being divided into three subgrades which were assigned numerical values. These numerical values were used in calculating the average grade for each lot as indicated in Table 1. For example, prime was assigned the value of 14, and cull, the value of 1. Each point in these values represents one-third of a grade (Table 1).<sup>4</sup>

Table 1. Numerical Equivalents of Grades

Live Grades	Carcass Grades	Number
Prime.....	Prime .....	14
Choice, plus .....	Choice, plus .....	13
Choice.....	Choice .....	12
Choice, minus .....	Choice, minus .....	11
Good, plus .....	Good, plus .....	10
Good.....	Good .....	9
Good, minus .....	Good, minus .....	8
Medium, plus .....	Commercial, plus .....	7
Medium.....	Commercial .....	6
Medium, minus .....	Commercial, minus .....	5
Common, plus .....	Utility, plus .....	4
Common.....	Utility .....	3
Common, minus .....	Utility, minus .....	2
Cull .....	Cull .....	1

To obtain an additional estimate of live grades and yields, a livestock spe-

<sup>2</sup>The experiment was conducted in the period October 27, 1947 to March 6, 1948.

<sup>3</sup>The grader assigned by United States Department of Agriculture to the packing plant did the carcass grading in this study.

<sup>4</sup>The grading was done according to the Official Federal Carcass Grades for slaughter lambs before the changes made April 30, 1951.

cialist from the South Dakota State College Experiment Station graded the individual lambs and also made estimates of their yields.

In comparing the buyer's grade and yield estimates with the Federal carcass grade and actual yield, it is assumed that the latter two give an accurate indication of carcass value. Carcass yield is derived from live weight and carcass weight, both of which are determined by scales.

Carcass grades on the other hand are determined by an evaluation of factors which influence carcass excellence such as conformation, finish and quality. The evaluation of these factors is partly dependent on the individual judgment of each grader. Thus two or more graders, all following the same set of instructions, may grade carcasses differently, especially on borderline carcasses.

To examine the extent of variation in carcass grading, all carcasses were graded independently by graders representing the U. S. Department of Agriculture, the packing plant, and the State College Experiment Station. The extent of variation among graders is important in deciding whether the carcass method of marketing is practical. If there is a wide variation among individual graders in their judgment of the grade factors, returns from various packing plants may differ widely. In that case the carcass weight and grade method may not be an improvement over the present system.

In order to gain accuracy in both live and carcass grading, one-third of a grade was used. Each full grade has a wide range, thus the difference be-

tween top good and low good may be greater than between low good and top commercial. In borderline cases the use of full grades would tend to exaggerate variations in grading. The division of grades is shown in Table 1.

## Accuracy in Determining Yields

The first problem analyzed was how accurately a packer buyer could estimate the dressing percentages of lots of live lambs. The buyers made estimates of the yield for 27 lots. For five lots he did not make any estimate of lot yields; these were therefore excluded. When the buyer's estimates were compared to the actual yield, it was found that for 12 lots his error was within 1 percent. And only for two lots out of the 27 did his error exceed 4 percent (Table 2).

Table 2. Estimates of Dressing Percentage Compared to Actual Dressing Percentage for Lots

Difference Between Estimated and Actual Dressing Percentage Percent	Buyer No. of Lots	Experiment Station Grader No. of Lots
0-1 .....	12	15
1-2 .....	7	3
2-3 .....	1	3
3-4 .....	5	3
4-5 .....	1	1
5-6 .....	1	1

A yield error of 1 percent seems small, yet with lamb carcasses priced at \$50.00 per hundredweight that means an error of 50 cents per hundredweight. An error of 2 percent would mean a difference of \$1.00 and a 4 percent error, \$2.00.

The average yield for lambs included in this study was 48.4 percent. There was a tendency for the buyer to underestimate lots where the actual yield was over 48 percent, and to overestimate where the yields were less than 48 percent. This means that the buyer kept his estimate of individual lots too close to the over-all average. By so doing, he came close on each day's kill, but not for individual lots.

Of 13 lots yielding 48.4 percent or more, the buyer underestimated in 8 and overestimated in 5; in the remaining 14 lots which had yields of less than 48.4 percent, the yields were all overestimated. For a very large number of lambs, the buyer's estimates of yield would probably be closer to actual yields than it was in individual lots. Thus the average yield for all lots combined was 48.4 percent, the average of the buyer's estimates was 48.1 percent, an error of 0.3 percent which is relatively small. For individual lots, however, the errors ranged from 0 to 5 percent. Thus some producers

might not receive payment according to the dressing percentage of their lambs. For producers as a group, however, the returns would be approximately the same whether yield estimates from live animals or carcass weights had been used (Table 3).

The station grader made estimates of yields for 26 lots, but was unable to participate in the work on the remaining 6 lots. His estimates were very close to those made by the buyer and revealed the same tendency to underestimate higher yielding and overestimate lower yielding lambs.

### Accuracy in Determining Grade

Individual grading of live lambs was made by the buyer for 444 lambs.<sup>5</sup> These lambs were also graded by the Station grader, but it proved impossible during the experiment to make the two gradings entirely independent. The buyer and the Station grad-

<sup>5</sup>Three lots were omitted in this comparison because the buyer's live grade was not obtained.

Table 3. Grader's Estimate as Deviating from Actual Yield

Lots Yielding Over 48 Percent			Lots Yielding Less Than 48 Percent		
Actual Yield Percent	Buyer's Deviation Percent	Experiment Station Grader's Deviation Percent	Actual Yield Percent	Buyer's Deviation Percent	Experiment Station Grader's Deviation Percent
53.6	-5.0	-5.2	48.3	+ .2	- .1
51.5	-4.0	-4.0	48.0	+1.5	+1.1
51.4	-3.9	*	47.1	+1.9	+ .4
50.9	- .9	-2.4	47.0	+3.5	+2.1
50.7	+ .3	-3.7	46.9	+ .2	+ .6
50.3	+ .2	*	46.6	+1.4	+ .5
50.2	- .2	- .8	46.4	+ .4	+ .4
49.7	- .2	- .3	46.4	+1.6	+ .8
49.6	-3.1	-3.3	46.4	+1.8	+1.1
49.2	- .9	- .9	45.6	+ .4	+ .8
49.2	*	- .8	43.8	*	- .2
48.9	+1.6	+ .3	43.5	+ .5	+ .9
48.8	*	-2.8	42.7	+3.3	+3.4
48.7	+ .8	- .6	41.4	+3.6	*
48.4	+2.1	*	40.1	+1.4	+1.7

\*Estimate not obtained.

er were so close in their estimates that only the buyer grades will be considered in the following.

The buyer's live grades were equal to the Federal carcass grades for 19.1 percent of the lambs. In all, 53.1 percent of the estimates were accurate within one-third of a grade, and 77.4 percent of the carcasses were estimated within two-thirds of a grade. This indicates that the buyer's live grades corresponded closely to the Federal carcass grades (Table 4).

**Table 4. Buyer's Estimate of Carcass Grades from Live Lambs Compared to Actual Carcass Grades by Federal Grader**

Deviation from Federal Carcass Grades by Numerical Values*	Number of Lambs	Percent of Lambs
+6 .....	11	2.5
+5 .....	4	.9
+4 .....	18	4.0
+3 .....	46	10.4
+2 .....	82	18.4
+1 .....	91	20.5
0 .....	85	19.1
-1 .....	60	13.5
-2 .....	26	5.9
-3 .....	18	4.0
-4 .....	3	.8
Total .....	444	100.0

\*Each unit is equivalent to one-third of a grade.

Although the buyer was close to the actual carcass grades in the majority of cases, there was a tendency to undergrade lambs which graded choice and to overgrade lambs grading good or lower (Table 5).

## Economic Importance of Yield and Grade Errors

The data on the accuracy of the buyer's estimate of yield and grade show that there was a fairly close relationship between his estimates and the actual dressing percentages and carcass grades. However, the tendency to undergrade high quality and to overgrade low quality lambs penalizes the producer of better than average quality animals. The higher yielding lambs are also undervalued, and lower yielding lambs overvalued. Such errors in estimating grade and yield will be reflected in the returns to producers.

An analysis was made of the influence that each of the two types of errors in estimate had on the returns to producers. Since yield estimates were obtained on lots but not on individual lambs, this analysis had to be made on a lot basis. The first step was to calculate the wholesale value of the carcasses in each lot by multiplying carcass weight by the price corresponding to its carcass grade.<sup>6</sup>

To get the influence of error in estimating grade, the carcass price for the estimated grade of each lamb was multiplied by its actual carcass weight. The totals for each lot were

<sup>6</sup>Carcass grades by U.S.D.A. grader and prices paid the day of delivery at the packing plant were used.

**Table 5. Percentage of Buyer's Live Grade Which Was Higher, Equal or Lower Than Federal Carcass Grade for Each Grade Group**

Carcass Grade	No. of Lambs	Higher	Equal	Lower	Total
Choice .....	108	32.4	25.9	41.7	100
Good .....	173	54.3	18.5	27.2	100
Commercial .....	114	71.9	15.8	12.3	100
Utility .....	34	88.2	8.8	3.0	100
Cull .....	15	73.3	26.7		100



then added. This estimated value of the lot was then subtracted from the wholesale value of the lot to get the difference in returns caused by errors in estimating grade.

To get the difference in returns caused by errors in estimating yield, the buyer's estimate of yield was used to compute his expected carcass weight for the lot. This was multiplied by the average wholesale price for the lot.<sup>7</sup> The resulting figure was then subtracted from the actual wholesale value of the lot. For example if live weight of the lot is 1000 pounds, actual yield is 50 percent, and the buyer's estimated yield is 49 percent, then actual carcass weight would be 500 pounds and carcass weight expected by the buyer 490

pounds. At a price of 50 cents per pound, the buyer's expected value would be \$245.00 as against the actual value of \$250.00. The difference in returns would be \$250.00 — \$245.00 = \$5.00 or a 50 cent underpayment per hundred pounds live weight.

The errors in estimating yield were relatively larger than the errors in estimating grade. However, the grade errors have an important influence on the prices paid to producers because of the differential in prices between various grades. For example, a buyer purchasing 40 lambs estimates their average carcass grade to be good. The carcasses may show an average grade of good consisting, however, of 20 choice

<sup>7</sup>Average price of the lot was found by dividing wholesale value by carcass weight of the lot.

Table 6. Difference per Hundred Pounds Live Weight Between Estimated and Actual Value of Lots Caused by Errors in Estimating Grade and Yield

Lot Number	Error in Estimating Grade Dollars	Error in Estimating Yield Dollars	Total Influence of Grade and Yield Errors* Dollars
18	+2.10	+1.13	+3.23
15	+2.30	+1.13	+2.43
10	+1.59	+ .69	+2.28
22	+ .58	+1.50	+2.08
6	+ .58	+1.38	+1.96
26	+1.20	+ .21	+1.41
19	+ .36	+ .99	+1.35
16	+1.20	+ .11	+1.31
27	+ .32	+ .85	+1.17
32	+ .29	+ .72	+1.01
11	+ .38	+ .59	+ .97
2	+ .02	+ .71	+ .73
14	+ .27	+ .33	+ .60
12	+ .45	+ .03	+ .48
20	+ .26	+ .09	+ .35
7	+ .10	+ .14	+ .24
21	+ .50	+ .43	+ .07
23	— .05	+ .09	+ .04
9	+ .10	— .09	+ .01
3	— .15	— .0	— .15
25	— .21	— .40	— .61
4	+ .01	—1.31	—1.30
17	+ .08	—1.76	—1.68
5	+ .14	—1.88	—1.74
1	— .41	—1.87	—2.28

\*Interaction between yield and grade errors not included because of the statistical limitations of the data.

and 20 commercial carcasses. If the price differential between choice and good is the same as between good and commercial there will be no difference between the returns to the seller from either method of marketing. On the other hand, there will be a difference in returns if the differential between choice and good is smaller or larger than between good and commercial.

The difference in returns which could be attributed to *grade error* were over two dollars per hundredweight in two lots, and over one dollar per hundredweight in three lots. *Yield errors* caused a difference in returns of more than one dollar per hundredweight in seven lots with a maximum of \$1.88. The difference in returns when both yield and grade errors were taken into account exceeded three dollars per hundredweight for one lot, was over two dollars in four lots and over one dollar in nine lots (Table 6).

The difference in returns was larger on lots which had an average carcass grade of commercial or lower, than on lots averaging good or better. The reason for this is that the price differential between the lower grades is larger than between the higher grades. In the period in which this study was made, the average differential between choice and good was \$1.10, between good and commercial \$2.50, between commercial and utility \$5.81, and between utility and cull \$10.00 per hundred pound carcass weight. Thus if two lambs totaling 100 pounds carcass weight had been graded utility instead of cull, the seller would have received approximately

\$10.00 too much, while a similar error between choice and good would make a difference of only \$1.00. These differentials do, of course, change from time to time, but the spread between utility and cull is usually larger than between the other grades.

This factor is of considerable practical importance, especially if it is assumed that total payments to all producers selling lambs will remain unchanged whatever method of marketing is used. Under the present system, producers selling a large percentage of low grade lambs would receive too much, while those producing better quality lambs, correspondingly less (Table 7).

Table 7. Difference in Value per Hundred Pound Live Weight According to Average Carcass Grade of Lot

AVERAGE GRADE OF LOT		
Lot No.	Carcass Grade of Lot	Grade Error in Dollars
25	Choice—	— .21
5	Choice—	+ .14
1	Good+	— .41
3	Good+	— .15
23	Good+	— .05
2	Good+	+ .02
7	Good+	+ .10
9	Good+	+ .10
17	Good	+ .08
14	Good	+ .27
27	Good	+ .32
20	Good—	+ .26
32	Good—	+ .29
19	Good—	+ .36
11	Good—	+ .38
21	Good—	+ .50
4	Commercial+	+ .01
6	Commercial+	+ .58
22	Commercial+	+ .58
10	Commercial+	+1.59
12	Commercial	+ .45
16	Commercial—	+1.20
26	Commercial—	+1.20
15	Utility	+2.30
18	Utility—	+2.10

## Carcass Grade Standards

In the foregoing analysis it has been necessary to assume that the carcass grades are true grades, in other words that individual graders would apply grade standards uniformly. As long as grades are based on evaluation of subjective grade factors there will be room for considerable variation in judgment among various graders. Ideally, grade factors should be established by some objective factors such as measurement, weight or color. So far no such objective factors have been developed. This lack of objective grade standards is one of the arguments which can be raised against introduction of the carcass weight and grade method of marketing lambs.

Objective carcass grade standards have been developed for hogs<sup>8</sup> which have been widely used in foreign countries and have also been introduced at some packing plants in this country. Proposals for new grade standards for hog carcasses and live hogs have recently been submitted by the Production and Marketing Administration, U.S.D.A. There are official United States grades for both live lambs and carcasses. These grades are based on an evaluation of conformation, finish, and quality.

If payments to producers are to be made on the basis of carcass weight and grade, the extent of the variation in judgments among individual graders has to be known before any recommendation about introduction of the method can be made. This is the object of this part of the study in which 483 carcasses were graded independently by a packer and an Experiment Station grader. Their grades

were then compared to grades arrived at by a Federal grader. The packer grader agreed with the Federal grader on 36.7 percent of the lambs, overestimated by one-third of a grade for 29.0 percent and underestimated by the same amount for 15.7 percent of the lambs. In all, 81.4 percent of his grades were within plus or minus one-third of the Federal grade. The Station grader agreed with the Federal grader on 41 percent of the lambs and was within one-third of a grade for 83.6 percent. Both the packer and the Station grader tended to grade higher than the Federal grader, the packer grader being higher for 44.5 percent and lower for 18.8 percent of the lambs, and the Station grader higher for 41.8 and lower for 17.2 percent (Table 8).

Carcass grades based on subjective standards have the basic weakness that variation in individual judgment will influence the grades. In purchasing lambs the buyer makes an estimate of the average grade for the lot, and continuously checks this estimate against the corresponding average carcass grade. A change of buyers in the plant might conceivably change the live grades and consequently the returns to producers. In order to determine whether such variations would be important, the average carcass grades of the three graders were examined for 31 lots.

The average grades for each lot proved to be very close for the three graders. The packer grader's average

<sup>8</sup>An effort to determine objective standards for hog carcasses was made in "Marketing Slaughter Hogs by Carcass Weight and Grade," Technical Bulletin 187, University of Minnesota Agricultural Experiment Station, 1950.

Table 8. Comparison of Carcass Grades By Packer Grader, Station Grader and Federal Grader

Deviation of Packer Grades from Federal Grades by 1/3 of Grade	Number of Lambs	Percentage of Lambs	Deviation of Station Grades from Federal Grades by 1/3 of Grade	Number of Lambs	Percentage of Lambs
+4	4	.8	+4	0	0
+3	10	2.1	+3	15	3
+2	61	12.6	+2	47	9.7
+1	140	29.0	+1	141	29.1
0	177	36.7	0	198	41.0
-1	76	15.7	-1	65	13.5
-2	13	2.7	-2	16	3.3
-3	2	.4	-3	1	.1
-4	0	0.0	-4	0	0
<b>Total</b>	<b>483</b>	<b>100.0</b>	<b>Total</b>	<b>483</b>	<b>100.0</b>

agreed with the Federal grader's in 16 lots, and the Station grader's with the Federal grader's in 17 lots. In no case

was the difference between the three graders' average grades for lots more than two-thirds of a grade.

### Summary and Conclusions

This is a preliminary study of marketing lambs by carcass weight and grade instead of by live weight. The main emphasis was placed on examining how adequately sale by live weight reflects to producers the value of lambs.

The method used was to have a packer buyer grade lambs and make estimates of their yields. These estimates were then compared to the carcass grades by a Federal grader and actual yields derived from carcass weights. The economic importance of errors in estimating yields and grade was then determined on the basis of carcass prices at the packing plant the day of delivery.

If prices are to be determined on the basis of carcass grades and yields, carcass grades have to be uniformly applied by various graders. A comparison was therefore made of carcass grading of the three graders.

Results from the study show that estimates of carcass grades and

weights from live animals are not accurate. The buyer's errors in estimating yield were greater in magnitude than his errors in estimating grade. However, because of variations in price differentials between grades, grade and yield errors had about equal influence on the returns to farmers.

Grades for better quality lambs tended to be underestimated and grades for lower quality animals to be overestimated. Similarly, the buyer underestimated yields of high yielding lambs and overestimated on low yielding lambs.

Of special importance is the fact that upgrading of low quality lambs gives the producer of low grade animals a disproportionately large return, because the price differentials between the lower grades are larger than between the higher grades. The result is that producers of lambs grading good and better tend to be underpaid even when the grade of their ani-

mals is estimated correctly. Thus marketing lambs on live basis does not adequately reflect their carcass values. The difference in returns to producers when carcass grades and weights were used instead of the buyer's estimate of grade and yield amounted to more than \$3.00 per hundredweight in one lot, exceeded \$2.00 in four lots, and was over \$1.00 in nine lots. In the remaining 11 lots the difference was less than \$1.00 per hundredweight.

Comparison of carcass grades by two graders with grades by a Federal grader shows that, in the majority of cases, grades differed from the Federal carcass grades by no more than two-thirds of a full grade. Although the results are not conclusive, they indicate that carcass grades by well-trained graders will correspond closely.

Adoption of the carcass weight and grade method of selling livestock cannot be recommended before it is determined whether this system is practically feasible, taking into consideration present working procedure in packing plants. A number of problems have to be studied in order to give a definite answer to this question. Among the more important of these are: (1) a satisfactory method of identification of ownership of lambs, (2) the effect of slaughtering costs, (3) the method of adjusting for differences in by-product values, (4) the extent of tissue shrinkage, both where animals are shipped from the market to a distant packing plant and where animals are held over in the packers' yards for some time before slaughter, and (5) possibilities of developing objective standards for carcass grades.